



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII  
726 MINNESOTA AVENUE  
KANSAS CITY, KANSAS 66101

Site: West Lake Landfill  
ID #: MOD 079900932  
Break: 1.5  
Other: comments  
8-6-92

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AUG 06 1992

Joseph Weyhrich, Esq.  
Lewis, Rice & Fingersh  
611 Olive  
Suite 1400  
St. Louis, Missouri 63101

RE: Earth City Industrial Park  
St. Louis, Missouri



40051592  
SUPERFUND RECORDS

Dear Mr. Weyhrich:

We have just recently concluded a preliminary review of the following reports submitted by the U.S. Real Estate Division of Ford Financial Services for the above-referenced site: (1) Phase II Investigation Report (Dames & Moore Job No. 19943-002-045) dated June 14, 1990; (2) Phase III Radiological Site Assessment (Dames & Moore Job No. 19943-004-045) dated June 11, 1991; and (3) Data Package for Soil and Groundwater Samples Collected in April 1990 by Dames & Moore. We offer the following comments on such reports:

REVIEW COMMENTS

Phase II Investigation Report - Earth City, Missouri.  
June 14, 1990.

1. Comment: Gross Alpha Result from Sample S4. (Pages 6-8.)

The gross alpha value for Sample S4 (sediment) was 6.6 times background (219 pCi/g vs 33 pCi/g). The same sample was reanalyzed by International Technology Corporation, whereupon a much lower gross alpha value was obtained. The report states that the re-analysis is more valid, based on the fact that the values reported for individual alpha-emitting nuclides add up to a value far less than the gross alpha result.

There are many additional alpha-emitters in nature that were not included in the individual analyses. The argument is poorly supported in this report by the text implying that decay products of the so-called "marker" nuclides would not be in addition to those nuclides that were analyzed.

2. Comment: Radionuclide Ratios in "Uncontaminated" Samples - Possible Spread. (Page 13.)

Soil and sediment samples from apparently-uncontaminated areas showed concentrations of the three predominant nuclides in the uranium-238 decay series as follows:

<u>Sample</u>	<u>Th-230</u>	<u>U-238</u>	<u>Ra-226</u>
BKG	3.58+/-0.61	1.1	1.1
UB-3	2.23+/-0.46	0.924 +/- 0.2	1.16+/-0.11
UB-4	2.11+/-0.42	0.738+/- 0.18	1.07+/- 0.12
C1	2.22+/-0.45	0.95+/-0.28	1.06+/-0.11
C2	2.37+/-0.43	0.765+/-0.201	1.15+/-0.12
S1	1.28+/-10.32	0.384+/-0.28	1.18+/-0.16
S2	2.25+/-0.40	1.07+/-0.29	1.29+/-0.12
S3	2.55+/-0.44	0.782+/-0.196	0.783+/-0.084
S4	2.38+/-0.49	0.638+/-0.21	1.18+/-0.11

All of these nominally-uncontaminated samples show thorium-230 at least marginally higher than either uranium-238 or radium-226. In natural equilibrium (secular), all would be present at the same activity level. If this slight elevation of thorium-230 is real, it suggests a low-level but widespread contribution from the West Lake Landfill waste. The West Lake Landfill waste has the distinctive property of thorium-230 activity level elevated well above uranium-238 and radium-226 activity levels.

3. Comment: Gross alpha result from sample MW-106U. (Table 11)

MW106-U groundwater sample reanalyzed 5/25/90 for gross alpha, showed a level of 307 +/- 133 picoCuries per gram, according to Table 11. This high result is in error according to the actual sampling sheet, which shows that the result is in picoCuries per liter. The units for environmental water samples are normally represented by picoCuries per liter.

Phase III Radiological Site Assessment - Earth City Industrial Park. June 11, 1991.

1. Comment: Emphasis Misplaced on Less Important Radionuclides.

The Executive Summary, page 1, second paragraph, makes the statement that "[t]he predominant nuclides present above background levels in this area (the northern "biased" location) are Ra-226 and U-238." The next paragraph states (bottom of page 1), "[p]redominant nuclides present above background levels in this region (the southern biased location) are also Ra-226 and U-238." Again in Subsection 3.3, SOIL SAMPLING AND ANALYSIS, it is stated that the "predominate contaminate" nuclides for the soil analyses

are Ra-226 and U-238, while referencing Table B1. These statements are inappropriate; Table B1 shows that thorium-230 contamination activity levels are many times higher than radium-226 and uranium-238 activity levels. It should also be noted that higher Dose Conversion Factors are associated with inhalation of thorium-230, as compared to uranium-238 or radium-226, reflecting a higher risk from each picoCurie of activity inhaled. Thorium-230 is the predominant contaminant which will drive all cleanup activities, but is never mentioned as a contaminant on the property in the text of this report.

The dominance of thorium-230 is to be expected, based on the premise that the contamination comes from St. Louis Downtown Site via the St. Louis Airport Site (SLAPS), the Latty Avenue Site, and the West Lake Landfill. The most distinctive feature of contamination at the SLAPS and Latty Avenue is thorium-230 activity levels much higher than activity levels of any other radionuclide.

In part because of the emphasis on radium-226 and uranium-238, the report's conclusions on area and depth of contamination in the two "hot spots" may be in error. (See additional comments following.)

2. Comment: Extent of Contaminated Area - Defined by Gamma Readings. (Page 8.)

The area of contamination used in estimating the contaminated soil volume (Subsection 3.4) is said to be based on gamma readings which exceed 27 microrem per hour +/- 10%. This number is arrived at by adding a 7 microroentgen/hr background to an external gamma radiation limit taken from the Uranium Mine Tailings Radiation Control Act regulations indicated in 40 C.F.R. Part 192, Subpart B. The limit found there is 20 microroentgen/hr, a standard for an occupied or habitable building. It does not apply to outdoor readings and is not supportable as an appropriate measure of the contaminated soil area on this property.

A gamma radiation level is not inherently an accurate reflection of the health hazard present. In most cases of environmental contamination, the health hazard will be dominated by risks from ingestion and inhalation of radionuclide contamination, which then irradiates the body tissues internally. This is especially true

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1 Federal Guidance Report No. 11, Limiting Values Of Radionuclide Intake And Air Concentration And Dose Conversion Factors For Inhalation, Submersion, And Ingestion. Derived Guides for Control of Occupational Exposure and Exposure-to-Dose Conversion Factors for General Application, Based on the 1987 Federal Radiation Protection Guidance. Keith F. Eckerman, Anthony B. Wolbarst, and Allan C. B. Richardson. EPA-520/1-88-020. DE89 011065.

for a site where thorium-230 is a major component of contamination, because thorium-230 emits too few and too weak gamma radiations to contribute significantly to the external gamma radiation level.

The two northern area samples (for 0-to-6-inches) were nearest grid point N2 and the four southern area samples were nearest grid point L53. Both of these grid points showed gamma readings in the 50 to 60 microR/hr range. The samples showed thorium-230 levels many times (several 100 times) the residual contamination guideline of 5 picoCuries per gram used by the Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) for radium and thorium in the surface 6 inches. The Phase III report underestimates the surface area that is contaminated above an appropriate clean-up standard.

An apparent contradiction in contaminant distribution exists between the Oak Ridge Associated Universities (ORAU) 1984 survey of the north face of the landfill and the Phase III report. ORAU selected for closer investigation an area based on the generally highest gamma readings obtained at the time. Based on the figures provided in the respective ORAU and Dames & Moore reports, the area investigated by ORAU is not directly up-grade from the currently contaminated locations. Figure 1 of the ORAU report shows the Survey Area mid-way between Old St. Charles Rock Road and the abrupt 90-degree turn made by the landfill boundary roughly half way between St. Charles Rock Road and Old St. Charles Rock Road. Referring to the Phase III report, this mid-way location places the detailed ORAU survey almost mid-way between the two currently contaminated areas but closer to the south contamination area.

The gamma survey data contained in Table A1 of the Phase III report does not indicate a contaminated area along the boundary at this latitude. Only a few scattered readings are reported as 8, 9, or 10 microR/hr, compared to a background of 7 microR/hr. In contrast, ORAU took two soil samples (S1 and S2, Figure 2, ORAU report) roughly 10 meters into the field along extended grid lines of the ORAU survey, and reported thorium-230 concentrations approximately 30 times the DOE guideline for surface soil or 10 times the DOE guideline for subsurface soil. No gamma readings are reported for the S1 and S2 sample locations. These locations do not appear to be biased by gamma readings, as they are shown on the extended grid lines. Based on this evidence, the possibility must be recognized that significant thorium-230 contamination may be spread into the field in locations where the gamma readings are below 10 microR/hr.

3. Comment: Depth of Radiological Contamination.

As with the extent of the contaminated area, the depth of contamination is also not well established and is underestimated in the conclusions of this report. The reason for the underestimate appears attributable to the fact the dominance of thorium-230 contamination was not evaluated.

For the northern area, it is stated (top of page 9) that the downhole gamma measurements show the contamination to exist in the first six to twelve inches of soil, and that this is substantiated by the soil analyses. These data do substantiate that the gamma radiation levels are substantially lower at 12 inches (and below) than they are at 6 inches, but the data do not establish that removal of the top 6 inches is sufficient to achieve cleanup levels.

Of the four soil samples analyzed from the northern area, F-026 and F-028 represent the top 6 inches, while F-027 and F-029 represent the 12-to-18-inch layer. The deeper samples show thorium-230 levels 2 times and 6 times the DOE/NRC subsurface contamination guideline of 15 pCi/g. Accordingly, the contamination above guidelines clearly extends well below 6 inches. Additional data is necessary to determine the vertical extent of contamination.

For the southern area, the depth of contamination is assumed to extend to 3 1/2 feet, over an area of 4 1/2 by 20 feet. However, no samples have been obtained from a depth of 3 1/2 feet. The single sample at 24" to 30" shows thorium-230 four to five times the residual contamination guideline of 15 pCi/g.

4. Comment: Affected Soils -- Volumetric Determination.

Subsection 3.4 calculates a volume of soil for removal at each of the two contaminated areas, northern and southern. No certain cleanup level or guideline is clearly stated for defining the extent of contaminated soil for removal. Rather, it is vaguely based on gamma readings over the area and guesses of the depth. As discussed above, these estimates underestimate significantly the volume of soil that would have to be removed to achieve a cleanup level such as the residual contamination guidelines of the DOE or NRC. Any removal action based on the existing information would have to cover a larger area than Dames & Moore has estimated, probably including the entire area where gamma readings are significantly above background.

5. Comment: Regulatory Review - Environmental Protection Agency.

Subsection 3.7.1 discusses primarily EPA "criteria" in the form of standards found in 40 C.F.R. Part 192, which may be an applicable or relevant and appropriate requirement (ARAR) for the site. In

most respects, the discussion is incorrect. Some discussion is given to the external gamma radiation level of 20 microroentgens per hour (referred to here as microrem) above background, said to be EPA "criteria for unrestricted release of sites containing residual amounts of uranium and thorium radioactivity". In 40 C.F.R. Part 192 this gamma radiation level is a limit for an occupied or habitable building and has no bearing on limits to protect against inhalation or ingestion of contamination. The term "unrestricted release" is also used in the Executive Summary, with reference to 40 C.F.R. Part 192, referring to "unrestricted release of radioactive contamination". This term is normally associated with NRC and DOE contamination guidelines, always applying to release of property from controls and never referring to a release of contamination.

Discussion is also given to the 40 C.F.R. Part 192 soil contamination limit of 5 pCi/g in the top 15 cm of soil and 15 pCi/g for any layer below the top 15 cm. This is a limit for radium in 40 C.F.R. Part 192, which is numerically the same as the DOE residual contamination guideline. However, DOE residual contamination guidelines apply also to thorium on the basis of protecting the public against risk. The thorium-230 levels presented in Table B1 are far higher than the radium-226 levels reported. Th-230/Ra-226 ratios range from 13 to 49 with all but 4 in the range of 43 to 49. Cleanup to the DOE residual contamination standard would have to reduce thorium-230 levels as well as radium-226 levels to the 5 pCi/g surface, 15 pCi/g subsurface, standard.

This standard is applied to an average over 100 square meters. The discussion refers to the north area of approximately 430 square meters and expresses the possibility that this area could have "high enough Ra-226 levels in the soil to cause the entire 100 square meters of surrounding Ford property to exceed these levels". This inconsistency seems to imply confusion between 100 square meters and a 100-meter square. The DOE/NRC contamination guidelines are averaged over 100 square meters, not a 100-meter square.

6. Comment: Regulatory Review - Nuclear Regulatory Commission.

The discussion regarding the NRC exposure limits in subsection 3.7.2 is incorrect. The first paragraph states that NRC exposure limits for a member of the general public is 500 microrem/yr and that recent changes reduce this value to 100 microrem/year. These statements are in reference to basic dose limits (not exposure) that are accepted by NRC and DOE, which are 500 millirem (not microrem) per year and 100 millirem per year respectively. These are in essence the same basic dose limits that are used by EPA and form the basis of 40 C.F.R. Part 192. To compare a possible dose

to these limits, it is necessary to estimate the dose that would result from all relevant exposure pathways, i.e. through ingestion and inhalation of contaminated soil on site and ingestion of any contaminated groundwater. These same dose limits form the basis for the DOE residual contamination guidelines, which cannot be met by the removal operation described in the Dames & Moore report.

The second paragraph states that, "[a]ssuming exposure times of 500 hours per year for gardening activities, the maximally exposed individual dose is estimated at 40 microrem/yr or 4 times the NRC proposed 'Below Regulatory Concern' limit of 10 microrem/yr". It is assumed that 40 millirem/yr, not microrem/yr, is intended, as 40 microrem/yr would be insignificantly small with respect to background. However, there is no basis given for the estimate of an annual dose, which would have to include assessment of dose received through various pathways such as inhalation of airborne dust, ingestion of soil, and direct gamma irradiation.

7. Comment: Correlation Between Constituents In Landfill and On Ford Property.

Both the Executive Summary and Subsection 3.5 discuss the correlation between landfill materials and constituents detected on the property, in order to establish that the contamination came from the landfill. The "correlation" claimed in this report is not supported. However, the data presented in the report do support the SLAPS/Latty Avenue origin of the radionuclide contamination.

Subsection 3.5 states that review of Section 4 of the NUREG-1308 (Rev 1) report shows that the "natural equilibrium of Ra-226 to U-238...is altered such that the Ra-226 to U-238 ratio ranges from 2:1 to 10:1...." Section 3.5 then presents a tabulation of "ratios for all samples" within the text on page 10. Seven of the 12 "ratios" presented are within the range of 2:1 to 10:1 (quoted from the NUREG report), and two others are close to that range at 1.5:1 and 11:1. However, none of these ratios are supported by the data.

As shown by the data summary of Table B1, all nine ratios within the range of 1.5:1 to 11:1 are "Ra-226/U-238" ratios for samples for which U-238 was reported as "ND". Examination of the laboratory reports suggests that Dames & Moore listed "ratios" that were based on the actual value reported for Ra-226 and the limit-of-detection listed for U-238. The limit-of-detection values were seen to vary widely from one sample to the next. Assuming the limit of detection numbers are correct, they could be used to place a lower limit on the Ra-226/U-238 ratio for each sample. However, such a lower limit can not show that the ratio is within a range.

For three of the twelve samples, both Ra-226 and U-238 data exist and therefore a legitimate ratio could be calculated. All three

samples show Ra-226/U-238 ratios that are less than unity, i.e., 1:2 (F-022), 1:3 (F-027), and 1:4 (F-029). These are well outside the range quoted from the NUREG report.

The effort to characterize the waste by its Ra-226/u-238 ratio is inappropriate at best, as the range of values cited for that ratio in the Latty Avenue and West Lake Landfill wastes is a wide range and not unique or highly unusual.

Although the Dames & Moore report fails to show that the contamination came from the West Lake Landfill, their sampling results do support the presumption that the contamination came from the West Lake Landfill and ultimately from the St. Louis Airport Site (SLAPS). The unusual and distinctive property of the contamination at those sites is the high ratio of thorium-230 to radium-226, not the ratio of uranium-238 to radium-226. The Dames & Moore data consistently show this high ratio of thorium-230 to radium-226. For the 12 soil samples reported in Table B1, the ratio of thorium-230 to radium-226 ranges from 13 (F-027) to 49 (F-024). Eight of the twelve samples show ratios between 43 and 49, eleven between 25 and 49. This unusual ratio apparently resulted from the practice of recovering the radium as well as the uranium from the Belgian Congo pitchblende processed at the St. Louis Site. This characteristic in the Dames & Moore soil samples is strong evidence that the West Lake Landfill is the source.

8. Comment: Groundwater Analyses -- Inconsistent Results for Uranium-238.

The Phase III report contains inconsistencies in the reporting of groundwater quality. Two types of results for uranium-238 are presented in the groundwater analysis results shown in Table B2. Under the heading of ISOURANIUM, results range from ND to 3.3+/-0.8 picoCuries per liter (pCi/L). Under the heading of GAMMA SCAN, uranium-238 levels include ND and a range from 510 to 1300 pCi/g. Individual sample sheets indicate a high limit of detection for those samples reported ND, and confirm that the units are pCi/g. This is inconsistent in the report, and the uranium-238 levels reported under GAMMA SCAN, if true, are indicative of groundwater contamination. The GAMMA SCAN results also show elevated levels of potassium-40 that appear to be significant. These results are also similar to results reported for the West Lake Landfill groundwater.

The water sample data sheets for Gamma Scan show the following results and (very high) limits of detection: (All values are pCi/g.)

<u>SAMPLE</u>	<u>U-238</u>	<u>K-40</u>	<u>U-238 LOD</u>	<u>K-40 LOD</u>
F001	ND	740	650	-
F002	1300	2000	-	-
F003	610	1000	-	-
F004	ND	730	730	-
F005	510	ND	-	280
F006	ND	820	830	-
F007	650	ND	-	340
F008	690	ND	-	300
F009	640	1100	-	-
F010	ND	800	660	-
F011	ND	4500	1100	-
F012	670	1100	-	-

(LOD - Limits of Detection)

The Phase III report does not discuss this inconsistency between U-238 results from two different analysis methods applied to the same groundwater samples, and in fact does not discuss groundwater results at all in the text of the Phase III Radiological Assessment. A single paragraph in the Executive Summary states that the analytical results "confirm that no migration of radioactive material into the shallow groundwater has occurred under the Ford property". It goes on to state that the analysis indicated no evidence of elevated U-238, then recommends an annual analysis program that omits the "gamma scan" analysis.

Data Package for Soil and Groundwater Samples Collected in April 1990 by Dames & Moore - Earth City, Missouri.

1. Comment: Lack of Data Submitted.

The only quality assurance/quality control (QA/QC) results provided for the organic data were the surrogate recoveries, and in some cases, matrix spike/matrix spike duplicate results. The metals analysis data package included only the results of the method blanks for some of the data submitted.

2. Comment: Data Review vs QA/QC Results

In order to make a determination of the quality of the data, the laboratory would have to provide all raw data and all QA/QC documentation for the following criteria:

Organics Data.

Holding times; GC/MS tuning; calibrations; blanks; surrogate recoveries; matrix spike/matrix spike duplicates; field duplicates; internal standards performance; laboratory control sample and tentatively identified compounds.

### Inorganic Data.

Holding times; instrument calibrations; preparation, calibration and method blanks; ICP interference check sample; matrix spike; laboratory duplicate; field duplicates; laboratory control sample; furnace atomic absorption analysis; ICP serial dilution; and detection limit results.

#### 3. Comment: Sample Locations

One of the purposes of the Phase II investigation was stated to be the collection and analysis of soil and sediment samples from locations where chemical or radiological contamination might reasonably be expected to have migrated from the landfill via surface water. The suspect areas were identified during the Phase I effort. The Phase II Report stated that one sediment sample, S3 was collected from the bottom of a ponded area near St. Charles Rock Road. According to the report the other sediment sample, S4, was collected from beneath an outlet of a surface water drain which originates at the base of the landfill berm. These sediment samples were submitted for analysis for organic and inorganic parameters as well as analysis for radiological parameters. Two composite soil samples were collected from an area south of Old St. Charles Rock Road. The soil samples were submitted for analysis for total petroleum hydrocarbons (TPH), semi-volatile organics, pesticides, PCBs, herbicides, metals, and cyanide. The Phase III Report states that the two composite soil samples were collected where soils dredged from the ditch along Old St. Charles Rock Road were believed to have been spread. This area is southwest of the two radiological contaminated "hot spots" on the Earth City property and across Old St. Charles Rock Road. The elevation of Old St. Charles Rock Road is higher than the land on either side and acts as a berm between the field where the "hot spots" are located and the field where the composite samples were collected. It is therefore unlikely that these samples are representative of the contamination existing on the Earth City Property. It is also unlikely that the sediment samples fully characterized all the areas where contamination may have migrated via surface water runoff. It has been suggested that the radiological contamination present in "hot spots" resulted from surface water runoff and mass movement of berm soils. It is therefore possible that organic and inorganic contaminants may also have migrated to the area via surface water runoff and mass movement to berm soils. Soil samples should be collected from the area of the "hot spots" and analyzed for organic, inorganic and radiological parameters to determine the magnitude and extent of contamination that exists on the property.

#### 4. Comment: Sample Depths

The soil samples collected during the Phase II investigation were collected at 0 to 12 inch depths. Subsurface soil samples should be collected from the two "hot spots" to characterize the magnitude

and extent of non-radiological contamination as well and to refine the extent of radiological contamination.

If you should have any questions regarding our review comments please contact me at (913) 551-7887.

Sincerely yours,

Diana L. Newman  
Project Manager  
Site Assessment and  
Federal Facility Section  
Superfund Branch  
Waste Management Division

cc: Steve Sturgess, MDNR  
Ken Lambert, NRC Region III  
Larry Bell, NRC HQ